

WHAT IS CLAIMED IS:

1. An ink cartridge for a printing apparatus providing ink to a print head through a tapered ink supply needle and removably attached to the print head, comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle.

2. An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically
 abutting against said packing member, said valve device
 selectively opening and closing said ink channel in conjunction
 with the ink supply needle, said valve device being urged by the
 ink supply needle of the printing apparatus to open said ink
 channel at a same time when the ink supply needle is sealed by
 said packing member.

3. An ink cartridge as set forth in claim 2, wherein said valve
 device comes to close said ink channel of said packing member
 before the ink supply needle of the printing apparatus is
 completely detached from said packing member.

4. An ink cartridge for a printing apparatus providing ink to
 a print head through an ink supply needle and removably attached
 to the print head, comprising:

an ink chamber for containing ink;

a porous member accommodated in said ink chamber for
 absorbing ink;

an ink supply port for supplying ink from said ink chamber
 to the print head of the printing apparatus, said ink supply port
 comprising an external opening;

a packing member provided in said ink supply port, forming
 an ink channel for allowing a flow of ink, said packing member
 sealing the ink supply needle of the printing apparatus by fitting
 therewith; and

a valve device contained in said ink supply port elastically
 abutting against said packing member, said valve device
 selectively opening and closing said ink channel in conjunction

with the ink supply needle.

5. An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith, said packing member comprising a hole and a protruding rim surrounding said hole; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle.

6. An ink cartridge as set forth in claim 5, wherein said packing member comprises a first surface facing said ink chamber formed with a cylindrical recess having a diameter acceptable to receive a part of said valve device at said first surface.

7. An ink cartridge as set forth in claim 6, wherein said hole of said packing member having a diameter smaller than said diameter of said cylindrical recess at said first surface.

8. An ink cartridge for a printing apparatus providing ink to

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a print head through an ink supply needle and removably attached to the print head, comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising a valve body contacting with said packing member and comprising a substantially flat surface with which the ink supply needle contacts.

9. An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

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a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising:

a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus; and

a guide body for guiding said valve body to slide substantially vertically with respect to said packing member.

10. An ink cartridge as set forth in one of claims 1, 2, 4 and 5, wherein said valve device comprises:

a valve member selectively contacting with a surface of said packing member, said valve member being forced by the ink supply needle of the printing apparatus when the ink cartridge is mounted on the printing apparatus; and

an elastic member always urging said valve member toward said packing member.

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11. An ink cartridge as set forth in claim 10, wherein said valve member comprises a support structure for supporting said elastic member.

12. An ink cartridge as set forth in claim 11, wherein said support structure is radially shaped.

13. An ink cartridge as set forth in claim 10, wherein said valve member comprises a flange for supporting said elastic

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14. An ink cartridge as set forth in claim 1, wherein said packing member comprises a second surface facing said external opening with a tapered portion tapered from said external opening toward said ink chamber at said second surface, for guiding the ink supply needle of the printing apparatus.

15. An ink cartridge as set forth in claim 14, wherein said tapered portion fits with the ink supply needle.

16. An ink cartridge as set forth in claim 1, wherein said packing member comprises a second surface facing said external opening with a fitting portion to fit with the ink supply needle of the printing apparatus.

17. An ink cartridge as set forth in claim 1, wherein said packing member is made of an elastic material and provided with a lubricant coat at least at an area with which the ink supply needle contacts.

18. An ink cartridge as set forth in claim 9, wherein said valve body comprises:

a sealing portion for closing said ink channel of said packing member when said valve device contacts with said packing member; and

an ink channel allowing ink to pass therethrough when said valve body is urged to come out of contact with said packing member by the ink supply needle of the printing apparatus.

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19. An ink cartridge as set forth in claim 18, wherein a part of said ink channel of said valve body is formed by cutting off said sealing portion.

20. An ink cartridge as set forth in claim 18, wherein said sealing portion of said valve body comprises a substantially flat surface with which the ink supply needle contacts.

21. An ink cartridge as set forth in claim 9, wherein said guide body comprises:

an axial portion being connected to said valve body; and
a guide block formed at an end of said axial portion opposite to said valve body, said guide block guiding said valve body to slide substantially vertically with respect to said packing member.

22. An ink cartridge as set forth in claim 21, wherein said axial portion of said guide body is formed as one unit with said valve body.

23. An ink cartridge as set forth in claim 21, further comprising a guide unit provided in said ink supply port to receive said guide block of said guide body.

24. An ink cartridge as set forth in claim 9, wherein said valve body and said guide body are separately formed and fixed to each other by fixing means.

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25. An ink cartridge as set forth in claim 9, wherein said valve body and said guide body are formed as one unit with each other.

26. An ink cartridge as set forth in claim 9, wherein said guide body is made of an elastic material.

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27. An ink cartridge as set forth in claim 21, wherein said guide body is made of an elastic material and formed with a groove extending from said guide block through said axial portion.

28. An ink cartridge as set forth in claim 9, wherein said valve body of said valve device comprises a surface facing said packing member formed with a convex surface.

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29. An ink cartridge as set forth in claim 9, wherein said valve body of said valve device comprises a surface, facing said packing member, formed with a protruding portion to contact with a tip end of the ink supply needle.

30. An ink cartridge as set forth in claim 9, wherein said valve body of said valve device comprises a surface, facing said packing member, provided with a notch.

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31. An ink cartridge as set forth in claim 30, wherein said notch of said valve body has a tapered angle which is the same as that of the tapered ink supply needle.

32. An ink cartridge as set forth in claim 30, wherein said channel of said valve body has a tapered angle which is smaller

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 than that of the tapered ink supply needle.

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 33. An ink cartridge as set forth in one of claims 8 and 9, wherein said valve body of said valve device comprises a surface formed with a spherical surface contacting with said packing member.

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 34. An ink cartridge as set forth in claim 33, wherein said spherical surface of said valve device has a diameter of curvature larger than a diameter of a widest part of said valve body.

35. An ink cartridge as set forth in claim 8, wherein said packing member comprises a first surface facing said ink chamber with a protruding portion having a hole whose diameter is smaller than the diameter of the ink supply needle of the printing apparatus.

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 36. An ink cartridge as set forth in one of claims 8 and 11, wherein said spherical surface of said valve device is formed with a flat portion with which the ink supply needle contacts.

37. An ink cartridge as set forth in claim 1, 2, 4 and 5, wherein said valve device comprises:

a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus; and

an elastic support portion for supporting said valve body.

38. An ink cartridge as set forth in claim 1, 2, 4, 5, 8 and 9, further comprising a packing retainer for retaining said packing member at said external opening of said ink supply port.

39. An ink cartridge as set forth in claim 38, wherein said packing retainer comprises a film capable of being penetrated by the ink supply needle of the printing apparatus.

40. An ink cartridge as set forth in claim 39, wherein said film is formed with a hole which enables the ink supply needle to easily pass through.

41. An ink cartridge as set forth in claim 40, wherein said hole is formed by cutting said film in a cross shape.

42. An ink cartridge as set forth in claim 38, wherein said packing retainer is a protruding portion protruding from said external opening toward the center thereof.

43. An ink cartridge as set forth in claim 16, wherein said fitting portion comprises a first fitting position for fitting the ink supply needle of the printing apparatus when the ink supply needle is inserted from said external opening, and a second fitting position for fitting the ink supply needle when the ink supply needle is further inserted toward said ink chamber.

44. An ink cartridge as set forth in claim 43, wherein said first fitting position is initially sealed prior to use.

45. An ink supply system for a printing apparatus providing ink to a print head through a tapered ink supply needle, said ink supply system capable of providing ink contained in a ink chamber to the print head through the ink supply needle, comprising:

an ink channel for providing ink from said ink chamber to the print head of the printing apparatus;

a first member provided at said ink channel, forming a part of said ink channel for allowing a flow of ink, said first member sealing the ink supply needle of the ink printing apparatus by fitting therewith; and

a second member contained in said ink channel elastically abutting against said first member, said second member selectively opening and closing said ink channel in conjunction with the ink supply needle.

46. A printing apparatus for ejecting ink on a printing medium, comprising:

a print head;

a tapered ink supply needle; and

an ink cartridge capable of communicating with said print head through said tapered ink supply needle and removably attached to said print head,

said ink cartridge comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member

sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle.

47. A printing apparatus as set forth in claim 46, wherein said valve device comprises:

a valve member selectively contacting with a surface of said packing member, said valve member being forced by said ink supply needle of the printing apparatus when said ink cartridge is mounted on the printing apparatus; and

an elastic member always urging said valve member toward said packing member.

48. A printing apparatus for ejecting ink on a printing medium, comprising:

a print head;

an ink supply needle; and

an ink cartridge capable of communicating with said print head through said tapered ink supply needle and removably attached to said print head,

said ink cartridge comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

a packing member provided in said ink supply port, forming

an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising a valve body contacting with said packing member and comprising a substantially flat surface with which the ink supply needle contacts.

49. A printing apparatus for ejecting ink on a printing medium, comprising:

a print head;

an ink supply needle; and

an ink cartridge capable of communicating with said print head through said tapered ink supply needle and removably attached to said print head,

said ink cartridge comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device

a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus; and

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